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DRUGS WORKING GROUP

Education and Training Outline for Forensic Drug Practitioners

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INTRODUCTION

The need for training has been recognized by the ENFSI Drugs Working Group as essential to improve the performance of laboratories to meet internationally accepted standards and to provide their clients (law enforcement, judiciary/regulatory and health authorities) with reliable data.

The purpose of this Training Manual Outline is to provide a source to qualified persons involved in delivering drug training courses, for a uniform formal training program for forensic drug practitioners.

Forensic practitioners carry out a variety of roles (all or in part) that have been recognized and should be defined in their organizations. These roles are fundamentally four, Scene of crime examiner, Analyst/Assistant, Reporting analyst and Reporting Scientist (as defined in ENFSI "Guidance on the assessment of competence for forensic practitioners", QCC-CAP-006).
The primary duty of a forensic practitioner is the analysis of physical evidence and the forming of an opinion based on the results of analysis. The duties which forensic practitioners are involved in within the frame of their roles and which need to be covered by training include:

- Evidence handling (obtaining, protecting, processing, testing, transporting, ensuring chain of custody)
- Evidence analysis (-all or in part- directing or carrying out casework examinations or analytical tests and development of laboratory examination strategy : identification, quantification, comparison, interpretation of the analysis results, implementation of good laboratory practices, writing the analysis report)
- Court testimony (skillful presentation of factual evidence for the court and defense of analytical findings)
- Participation in field investigations (initial assessment at a crime scene, e.g. clandestine laboratories and the subsequent collection of material for a detailed scientific examination)
- Technical and scientific support for law enforcement agents, prosecutors and/or the judiciary (communication, training, joint investigative teams)

Objectives of the Drugs Training Course outlined herein :

Upon completion of the training outlined herein, the trainees will have the requisite knowledge and skills to establish a standard of professional competency, as described in training records and comprising of (all or in parts) :

- knowledge of :
  - background information on drugs of abuse (morphology, basic chemistry, abuse patterns and pharmacology)
  - control regime of the most common drugs of abuse encountered on the illicit market (nationally/internationally)
  - production or synthesis of drugs of abuse and their key precursors
  - theory, principles and applications, of a variety of instrumentation and analytical techniques, including preventive maintenance and troubleshooting, possibilities, limitations and pitfalls
  - protocol for the qualitative and quantitative analysis
  - procedures applied in the laboratory and in the scene of crime, including chain-of-custody, as well as procedures related to law (court testimony)
  - quality management system and practices of the laboratory
  - health, safety and security related issues
- ability in :
  - preparation of samples and handling of evidence, choosing the best case approach
  - performing accurate qualitative and quantitative analysis independently and proficiently
  - application of quality system, practices and protocol(s) in daily routines
  - implementation of analytical schemes and methodologies
  - correct interpretation of the results obtained
  - reporting, communication of analytical findings, presentation and defending them in court

This training curriculum aims to cover completely the topics relevant for forensic practitioners, depending on role(s) recognized by the respective organizations. However, it does not attempt to completely cover all

the methodology available to the drug analyst. The selection of methods to solve particular analytical problems is the responsibility of the analyst, depending on the availability of other national scientific and laboratory facilities, on local crime trends, and on current workloads. If this training curriculum is used for international training, it should be recognized that it is unlikely that all topics can be covered completely. Some choice needs to be made with respect to which modules are covered or which ones are prioritized.

The chapters of the training manual follow a common structure, including objectives, suggestions for modes of instruction (training aids), key references (hyperlinked, where available), and suggestions for trainee assessment.

As education and training is an ongoing and periodical process so as to maintain the competence, this outline will undergo revision in periodic intervals. The actual version is published on the ENFSI website www.enfsi.eu

Definitions used in this Training Manual Outline

Knowledge:	Theoretical understanding of the scientific approach and the principal behind the analysis itself. It implies an understanding of the underlying theory of the particular analysis/examination (e.g. mechanisms, reactions, limitations, etc.). Knowledge is acquired through a formal and informal learning process.
Ability:	Practical ability to carry out an analysis/examination properly. Ability is acquired through practice.
Awareness:	Familiarity with a particular issue. It implies the need to know certain information in order to be able to take it into account in a relevant and appropriate manner.
Competence:	The ability to perform the task of a certain role. A competent person has the knowledge and the ability to apply this knowledge, has the skills, the right behaviour and the attitudes for the role. Qualification, experience and training, although important, do not guarantee competence.
Competence Assessment:	A formal assessment to check whether or not an individual meets the standards of performance.

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I. FUNDAMENTAL DRUG CHEMISTRY OVERVIEW

I.1. INTRODUCTION TO DRUG CHEMISTRY - What is a Drug

I.1.1. Objectives

Familiarity with, definitions, nomenclature, sources and chemical classifications of drugs

I.1.1.1. Nomenclature including IUPAC, general names and street names
I.1.1.2. Structural knowledge and relationship of isomers, analogues, homologues, derivatives with respect to chemical and legal aspects
I.1.1.3. Knowledge of natural, semi-synthetic and synthetic sources of drugs
I.1.1.4. Knowledge of how drugs can be classified as acids, neutrals and bases
I.1.1.5. Knowledge of how drugs can be classified by pharmacological effects
I.1.1.6. Familiarity of the effect of solubility and salt forms to the drug identification process

I.1.2. Modes of Instruction – Training Aids

I.1.2.1. Studying of suggested references/assignments
I.1.2.2. Demonstrations of samples
I.1.2.3. Clarification on questions
I.1.2.4. Discussion

I.1.3. References

I.1.3.1. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
I.1.3.2. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press, Vol 1, pp. 37-52
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I.1.3.6. Drugs of Abuse Information, National Institute on Drug Abuse
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I.1.3.11. "Forensic Chemistry", Bell, S. Pearson-Prentice Hall (2006), 1st edition, Upper Saddle River, NJ, USA. Chapter 6.

I.1.4. Assessment

I.1.4.1. Study questions (oral, written)
I.1.4.2. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.1. CANNABIS

II.1.1. Objectives

II.1.1.1. Familiarity with the illicit cannabis products :
- II.1.1.1.1. Description of the cannabis plant and illicit cannabis products (names and synonyms, botany, physical appearance, morphological, microscopical and chemical characteristics, herbal products, cannabis resin, liquid cannabis)
- II.1.1.1.2. Breeding of cannabis plant (outdoor/indoor/industrial production, harvesting, yield)
- II.1.1.1.3. Production of illicit cannabis products (herbal/resin/liquid cannabis)
- II.1.1.1.4. Chemical constituents of forensic significance of illicit cannabis products
- II.1.1.1.5. Pharmacology of cannabis products
- II.1.1.1.6. Legal aspects concerning cannabis in national/EU/international legislation, including hemp grown for fiber

II.1.1.2. Familiarity with Cannabis Receptor Agonists (cannabinomimetic compounds, e.g. 'spice' products), including legal aspects

II.1.1.3. Familiarity with the protocol for the analysis of illicit cannabis products (including sampling, physical examination, microscopy, extraction, presumptive (colour) tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls).

II.1.1.4. Familiarity with additional analytical techniques for the analysis of cannabis

II.1.1.5. Ability to perform identification of illicit cannabis products

II.1.1.6. Familiarity with analysis and identification of cannabinomimetic compounds

II.1.1.7. Ability to perform quantification of constituents of illicit cannabis products

II.1.2. Modes of Instruction – Training Aids

II.1.2.1. Studying of suggested references/assignments

II.1.2.2. Clarification on questions

II.1.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.1.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.1.2.5. Interpretation of results and discussion including limitations

II.1.2.6. Application of qualitative/quantitative analysis on known samples by trainee

II.1.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.1.2.8. Discussion

II.1.3. References

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II.1.4. Assessment

II.1.4.1. Study questions (oral, written)

II.1.4.2. Preparation of samples and reagents (practical)

II.1.4.3. Distribution and application of analysis on unknown samples (practical)

II.1.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.2. OPIUM ALKALOIDS AND OPIUM DERIVATIVES (HEROIN)

II.2.1. Objectives

II.2.1.1. Familiarity with the opium, opium alkaloids and opium derivatives (heroin), including semi-synthetic opioids (oxycodone, hydrocodone, etc) :
- II.2.1.1.1. Description/recognition of illicit opium products (botany, physical appearance, morphological and chemical characteristics, opium preparations)
- II.2.1.1.2. Production of illicit opium products (isolation of morphine from opium, manufacture of heroin from morphine)
- II.2.1.1.3. Chemical constituents of forensic significance of illicit opium products and derivatives, including by-products, adulterants and diluents, comparative analysis / establishing links between samples
- II.2.1.1.4. Structures and pharmacology of constituents of opium, opium derivatives (heroin) and semi-synthetic opioids
- II.2.1.1.5. Legal aspects concerning opium, opium derivatives (heroin) and semi-synthetic opioids in national/international Legislation

II.2.1.2. Familiarity with the protocol for the analysis of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids (including sampling, physical examination, microscopy, extraction, presumptive (colour/anion) tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.2.1.3. Familiarity with additional analytical techniques for the analysis of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.1.4. Ability to perform identification of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.1.5. Ability to perform quantification of constituents of illicit opium, opium products, opium derivatives (heroin) and semi-synthetic opioids

II.2.2. Modes of Instruction – Training Aids

II.2.2.1. Studying of suggested references/assignments
II.2.2.2. Clarification on questions
II.2.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
II.2.2.4. Demonstrations of samples and of analysis by trainer, with explanations
II.2.2.5. Interpretation of results and discussion including limitations
II.2.2.6. Application of qualitative/quantitative analysis on known samples by trainee
II.2.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee
II.2.2.8. Discussion

II.2.3. References

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II.2.4. Assessment

II.2.4.1. Study questions (oral, written)
II.2.4.2. Preparation of samples and reagents (practical)
II.2.4.3. Distribution and application of analysis on unknown samples (practical)
II.2.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.3. COCAINE

II.3.1. Objectives

II.3.1.1. Familiarity with the coca plant and illicit materials containing cocaine :
- II.3.1.1.1. Description/recognition of coca plant and illicit materials containing cocaine (botany, physical appearance, morphological and chemical characteristics)
- II.3.1.1.2. Production of illicit materials containing cocaine (isolation of cocaine from coca leaf, production of coca paste, cocaine base, “crack”) and manufacture of cocaine
- II.3.1.1.3. Chemical constituents of forensic significance of coca plant and illicit materials containing cocaine, including by-products, adulterants and diluents, comparative analysis / establishing links between cocaine samples
- II.3.1.1.4. Structures, physical data and pharmacology of constituents of illicit materials containing cocaine
- II.3.1.1.5. Legal aspects concerning coca plant and illicit materials containing cocaine in national/international Legislation

II.3.1.2. Familiarity with the protocol for the analysis of illicit materials containing cocaine (including sampling, physical identification, extraction, presumptive (colour/odour/microcrystal) tests, anion tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.3.1.3. Familiarity with additional analytical techniques for the analysis of cocaine

II.3.1.4. Ability to perform identification of cocaine in illicit materials

II.3.1.5. Ability to perform quantification of constituents of illicit materials containing cocaine

II.3.2. Modes of Instruction – Training Aids

II.3.2.1. Studying of suggested references/assignments

II.3.2.2. Clarification on questions

II.3.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.3.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.3.2.5. Interpretation of results and discussion including limitations

II.3.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing cocaine by trainee

II.3.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.3.2.8. Discussion

II.3.3. References

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II.3.4. Assessment

II.3.4.1. Study questions (oral, written)

II.3.4.2. Preparation of samples and reagents (practical)

II.3.4.3. Distribution and application of analysis on unknown samples (practical)

II.3.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.4. AMPHETAMINE TYPE STIMULANTS (ATS)

II.4.1. Objectives

II.4.1.1. Familiarity with the Amphetamine Type Stimulants :
a. Non-ring substituted amphetamines (e.g. amphetamine, methamphetamine, cathine, cathinone, methcathinone, fenetylline)
b. Methylenedioxy substituted amphetamines (e.g. MDA, MDMA, MDEA, FLEA, MBDB)
c. Other ring substituted amphetamines (also in section "Hallucinogens")
- 2,4,5-Ring substituted phenethylamines (e.g. 2C-B, 2C-T, 2C-T-2, 2C-T-7, 2C-C, 2C-I)
- 2,4,5-Ring substituted amphetamines (e.g. TMA-2, STP/DOM, DOB, DOC, DOI, DOET)
- Other ring substitution patterns (phenethylamines and amphetamines) (e.g. Mescaline, PMA, PMMA, DMA, TMA, 4-MTA)

II.4.1.1.1. Classification and respective definitions
II.4.1.1.2. Description of compounds, physical and chemical characteristics, stereochemistry
II.4.1.1.3. Illicit ATS manufacture, including synthesis of amphetamine, methamphetamine and ring-substituted ATS (XTC-group etc)
II.4.1.1.4. Pharmacology of Amphetamine Type Stimulants
II.4.1.1.5. Legal aspects concerning Amphetamine Type Stimulants in national/international Legislation

II.4.1.2. Familiarity with the protocol for the analysis of Amphetamine Type Stimulants (including sampling, physical description, extraction, presumptive (colour/microcrystal/anion) tests, optical isomer analysis, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)
II.4.1.3. Familiarity with additional analytical techniques for the analysis of Amphetamine Type Stimulants
II.4.1.4. Ability to perform identification of ATS in illicit materials
II.4.1.5. Ability to perform quantification of ATS in illicit materials

II.4.2. Modes of Instruction – Training Aids

II.4.2.1. Studying of suggested references/assignments
II.4.2.2. Clarification on questions
II.4.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
II.4.2.4. Demonstrations of samples and of analysis by trainer, with explanations
II.4.2.5. Interpretation of results and discussion including limitations
II.4.2.6. Application of qualitative/quantitative analysis on known samples of ATS by trainee
II.4.2.7. Application of qualitative/quantitative analysis on unknown samples of ATS by trainee
II.4.2.8. Discussion

II.4.3. References

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II.4.4. Assessment

II.4.4.1. Study questions (oral, written)

II.4.4.2. Preparation of samples and reagents (practical)

II.4.4.3. Distribution and application of analysis on unknown samples (practical)

II.4.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.5. LSD AND HALLUCINOGENS (MESCALINE, PSILOCYBIN/PSILOCIN)

II.5.1. Objectives

II.5.1.1. Familiarity with the products containing LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescaline (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc, also referred to in section "ATS") :

- II.5.1.1.1. Description/recognition of illicit products containing LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescaline (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc)
- II.5.1.1.2. Illicit production/manufacture of LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescaline (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc)
- II.5.1.1.3. Chemical compounds, structures and pharmacology of LSD products. Chemical constituents of forensic interest in and pharmacology of Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms, as well as other substituted tryptamines and other hallucinogenic phenethylamines
- II.5.1.1.4. Legal aspects concerning LSD, Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines, Mescaline (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc) in national/international Legislation

II.5.1.2. Familiarity with the protocol for the analysis of LSD products (including physical identification, sampling, extraction, presumptive tests –fluorescence/colour/crystal tests-, TLC, GC, GC/MS, HPLC, FT-IR, analytical challenges)

II.5.1.3. Familiarity with the protocol for the analysis of Psilocybin/Psilocin (Psilocybe Mushrooms) and other substituted tryptamines (including physical -macroscopic and microscopic characteristics- identification, sampling, extraction, presumptive -colour- tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, special pitfalls)

II.5.1.4. Familiarity with the protocol for the analysis of Mescaline (Peyote Cactus - Mescal Buttons), as well as other hallucinogenic phenethylamines (2-CB, STP, DOB, TMA etc) (including physical -macroscopic and microscopic characteristics- identification, sampling, extraction, presumptive -colour- tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, special pitfalls)

II.5.1.5. Familiarity with additional analytical techniques for the analysis of LSD and hallucinogens (substituted tryptamines and hallucinogenic phenethylamines)

II.5.1.6. Ability to perform identification of LSD, Mescaline, Psilocybin/Psilocin, and other substituted tryptamines and hallucinogenic phenethylamines, in illicit materials, including Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms

II.5.1.7. Ability to perform quantification of LSD, Mescaline, Psilocybin/Psilocin and other substituted tryptamines and hallucinogenic phenethylamines, in illicit materials, including Peyote Cactus, Mescal Buttons and Psilocybe Mushrooms

II.5.2. Modes of Instruction – Training Aids

II.5.2.1. Studying of suggested references/assignments
II.5.2.2. Clarification on questions
II.5.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
II.5.2.4. Demonstrations of samples and of analysis by trainer, with explanations
II.5.2.5. Interpretation of results and discussion including limitations
II.5.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing LSD and hallucinogens by trainee
II.5.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee
II.5.2.8. Discussion

II.5.3. References

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II.5.3.12. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
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II.5.3.21. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009

II.5.4. Assessment

II.5.4.1. Study questions (oral, written)
II.5.4.2. Preparation of samples and reagents (practical)
II.5.4.3. Distribution and application of analysis on unknown samples (practical)
II.5.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.6. OTHER DRUGS AND PHARMACEUTICALS

II.6.1. Objectives

II.6.1.1. Familiarity with the illicit materials and pharmaceutical preparations containing controlled substances, as well as "designer" or new drugs, namely:
- benzodiazepine derivatives
- barbiturate derivatives
- synthetic opioids (pethidine, fentanyl and analogues, methadone, d-propoxyphene etc)
- GHB / GBL
- PCP and analogues, ketamine
- etc

II.6.1.1.1. Description/recognition of illicit materials and pharmaceutical preparations (physical appearance, morphological characteristics, markings)
II.6.1.1.2. Production/manufacture of illicit materials containing controlled substances
II.6.1.1.3. Chemical constituents of forensic significance of illicit materials and pharmaceutical preparations containing controlled substances
II.6.1.1.4. Structures and pharmacology of illicit materials and pharmaceutical preparations containing controlled substances
II.6.1.1.5. Legal aspects concerning illicit materials and pharmaceutical preparations containing controlled substances in national/international Legislation

II.6.1.2. Familiarity with the protocol for the analysis of illicit materials and pharmaceutical preparations containing controlled substances (including sampling, physical identification, presumptive tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls)

II.6.1.3. Familiarity with additional analytical techniques for the analysis of other drugs and pharmaceuticals

II.6.1.4. Ability to perform identification of illicit materials and pharmaceutical preparations containing controlled substances

II.6.1.5. Ability to perform quantification of illicit materials and pharmaceutical preparations containing controlled substances

II.6.2. Modes of Instruction – Training Aids

II.6.2.1. Studying of suggested references/assignments
II.6.2.2. Clarification on questions
II.6.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions
II.6.2.4. Demonstrations of samples and of analysis by trainer, with explanations
II.6.2.5. Interpretation of results and discussion including limitations
II.6.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing pharmaceuticals and other drugs by trainee
II.6.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee
II.6.2.8. Discussion

II.6.3. References

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Substances under International Control (No. II). Screening Colour Test and Specific Colour Test for the Detection of Non-barbiturate Sedatives and Hypnotics: Methaqualone and Mecloqualone", SCITEC/13, December 1996

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II.6.4. Assessment

II.6.4.1. Study questions (oral, written)

II.6.4.2. Preparation of samples and reagents (practical)

II.6.4.3. Distribution and application of analysis on unknown samples (practical)

II.6.4.4. Courtroom exercise (mini-mock trial)

II. DRUGS OF ABUSE

II.7. PROHIBITED SUBSTANCES IN DOPING CONTROL

II.7.1. Objectives

II.7.1.1. Familiarity with the illicit materials and pharmaceutical preparations containing substances prohibited in doping control, as described in the WADA list including:

- Anabolic agents (e.g. steroids) such as stanolone, methanedienone, nandrolone deconoate, testosterone, testosterone propionate
  - Familiarity with steroids classification (androgens, estrogens, adrenals) and steroid preparations
  - Descriptions of steroid formulations (oils, tablets, suspensions)
  - Chemical constituents of forensic significance
  - Structures and pharmacology of steroid preparations
  - Legal aspects concerning steroids
  - Familiarity with the protocol for analysis of steroids, for example, the advantages and limitations of the utilization of extractions, Kovat's indices, TLC, IR and GC/MS.
- Additional Prohibited Substances and Methods including :
  - peptide hormones, growth factors
  - beta-2 agonists
  - hormone antagonists and modulators
  - diuretics and other masking agents

II.7.1.1.1. Description/recognition of illicit materials and pharmaceutical preparations (physical appearance, morphological characteristics, markings)

II.7.1.1.2. Production/manufacture of illicit materials containing substances prohibited in doping control

II.7.1.1.3. Chemical constituents of forensic significance of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.1.4. Structures and pharmacology of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.1.5. Legal aspects concerning illicit materials and pharmaceutical preparations containing substances prohibited in doping control in national/international Legislation

II.7.1.2. Familiarity with the protocol for the analysis of illicit materials and pharmaceutical preparations containing substances prohibited in doping control (including sampling, physical identification, presumptive tests, GC/NPD, GC/MS, LC/MS, analytical challenges, special pitfalls)

II.7.1.3. Familiarity with additional analytical techniques (electrophoresis, ELISA, RIA-IRMA) for the analysis of substances prohibited in doping control

II.7.1.4. Ability to perform identification of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.1.5. Ability to perform quantification of illicit materials and pharmaceutical preparations containing substances prohibited in doping control

II.7.2. Modes of Instruction – Training Aids

II.7.2.1. Studying of suggested references/assignments

II.7.2.2. Clarification on questions

II.7.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

II.7.2.4. Demonstrations of samples and of analysis by trainer, with explanations

II.7.2.5. Interpretation of results and discussion including limitations

II.7.2.6. Application of qualitative/quantitative analysis on known samples of illicit materials containing substances prohibited in doping control by trainee

II.7.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

II.7.2.8. Discussion

II.7.3. References

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II.7.3.25. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012

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II.7.4. Assessment

II.7.4.1. Study questions (oral, written)

II.7.4.2. Preparation of samples and reagents (practical)

II.7.4.3. Distribution and application of analysis on unknown samples (practical)

II.7.4.4. Courtroom exercise (mini-mock trial)

III. PRODUCTION/MANUFACTURE OF DRUGS OF ABUSE

III.1. PRECURSORS (Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances)

III.1.1. Objectives

III.1.1.1. Familiarity with the substances frequently used in the illicit production/manufacture of narcotic drugs or psychotropic substances :

III.1.1.1.1. Description/recognition of the scheduled chemical substances used in the illicit production/manufacture of drugs of abuse, including their CAS and HS numbers, synonyms, physical appearance, chemical structure, properties, and their legitimate and illicit uses

III.1.1.1.2. Information on the essential precursors / raw materials, chemicals / reagents, and solvents known to have been used in the illicit production/manufacture of the most frequently trafficked/abused narcotic drugs and psychotropic substances, including common alternative or substitute chemicals and pre-precursors

III.1.1.1.3. Information on the production/manufacture of controlled substances, including description/recognition of synthetic and production routes and the processes used in clandestine laboratories

III.1.1.1.4. General information on the physical characteristics and safety requirements for the handling and storage of precursors, chemicals / reagents and solvents under international control

III.1.1.1.5. Legal and scientific issues related to the destruction of seized narcotic drugs, psychotropic substances, precursors and essential chemicals, as well as to clandestine laboratory investigations

III.1.1.2. Familiarity with the protocols for the analysis of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse (including mixtures, isomers and "markers") : sampling, physical identification, presumptive tests, TLC, GC, GC/MS, HPLC, LC/MS, FT-IR, analytical challenges, special pitfalls

III.1.1.3. Familiarity with additional analytical techniques for the analysis of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.1.4. Ability to perform identification of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.1.5. Ability to perform quantification of the chemical substances most frequently used in the illicit production/manufacture of drugs of abuse

III.1.2. Modes of Instruction – Training Aids

III.1.2.1. Studying of suggested references/assignments

III.1.2.2. Clarification on questions

III.1.2.3. Preparation of samples and of different reagents necessary for the analysis including review of safety precautions

III.1.2.4. Demonstrations of samples and of analysis by trainer, with explanations

III.1.2.5. Interpretation of results and discussion including limitations

III.1.2.6. Application of qualitative/quantitative analysis on known samples of chemical substances most frequently used in the illicit manufacture of drugs of abuse by trainee

III.1.2.7. Application of qualitative/quantitative analysis on unknown samples by trainee

III.1.2.8. Discussion

III.1.3. References

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III.1.3.7. "Clandestine Laboratory Guide for Agents and Chemists", United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

III.1.3.8. "Guidelines for the Safe Handling and Disposal of Chemicals Used in the Illicit Manufacture of Drugs", ST/NAR/36 rev.1, UNODC, 2011.

III.1.3.9. "Chemicals used in the Clandestine Production of Drugs", US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section

III.1.3.10. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

III.1.3.11. "Analysis of Drugs Manual", United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

III.1.3.12. "European Union Training Course for Trainers on the combating of Illicit Synthetic Drugs Laboratories, Course Standard", Europol, The Hague, 1999

III.1.3.13. "Multilingual Dictionary of Narcotic Drugs and Psychotropic Substances Under International Control (MLD)", UNODC, ST/NAR/1/rev.2, December 2006

III.1.3.14. "Multilingual Dictionary of Precursors and Chemicals frequently used in the Illicit Manufacture of Narcotic Drugs and Psychotropic Substances under International Control" (MLD)", UNODC, ST/NAR/1A, 2009

III.1.3.15. "Drug Identification Bible", Amera Chem., Inc., edition 2010

III.1.3.16. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press

III.1.3.17. "The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals", O'Neil, Maryadele J. et al, 14th Edition, 2006, 2009 by Merck & Co., Inc., Whitehouse Station, New Jersey, USA

III.1.3.18. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009

III.1.4. Assessment

III.1.4.1. Study questions (oral, written)

III.1.4.2. Preparation of samples and reagents (practical)

III.1.4.3. Distribution and application of analysis on unknown samples (practical)

III.1.4.4. Courtroom exercise (mini-mock trial)

III. PRODUCTION/MANUFACTURE OF DRUGS OF ABUSE

III.2 CLANDESTINE LABORATORIES

III.2.1. Objectives

III.2.1.1. Knowledge of the substances used in the clandestine production/manufacture of narcotic drugs and psychotropic substances :
- III.2.1.1.1. Essential precursors/raw materials
- III.2.1.1.2. Chemicals/reagents
- III.2.1.1.3. Solvents
- III.2.1.1.4. Knowledge of synonyms, physical appearance and characteristics, hazardous properties, legitimate and illicit use, storage and handling conditions for the substances used in the production/manufacture of drugs
- III.2.1.1.5. EU Voluntary Monitoring List
- III.2.1.1.6. Pre-precursors and alternative or substitute chemicals
- III.2.1.1.7. Awareness of classification in national, EU, international legislation

III.2.1.2. Knowledge of the production/manufacture of controlled substances :
- III.2.1.2.1. Production/manufacture of the substances under control most frequently encountered in the illicit market
- III.2.1.2.2. Various synthesis/processing schemes and routes
- III.2.1.2.3. Precursors, reagents and solvents used, respectively, per substance produced/manufactured
- III.2.1.2.4. Hazards and yields of synthetic route
- III.2.1.2.5. Synthesis of precursors

III.2.1.3. Knowledge of the investigation and dismantling of clandestine laboratories :
- III.2.1.3.1. Risk assessment (incl. criminal hazards, physical hazards, chemical hazards) in a clandestine laboratory
- III.2.1.3.2. Risk management (use of detection devices and personal protective equipment)
- III.2.1.3.3. Processing of a clandestine laboratory : - Registration
  - Documenting
  - Collection of evidence
  - Sampling
  - Storage and transport of samples and evidence
- III.2.1.3.4. Disposal of chemicals and cleanup of laboratory site

III.2.2. Modes of Instruction – Training Aids

III.2.2.1. Studying of suggested references/assignments
III.2.2.2. Clarification on questions
III.2.2.3. Demonstrations by trainer with explanations (in mock laboratory or real cases)
III.2.2.4. Practical exercise on investigation, risk assessment, risk management, processing of the laboratory, registration, documenting, sampling, disposal
III.2.2.5. Discussion

III.2.3. References

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III.2.3.2. "Data Sheets on Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances", SCITEC/9/REV.2, 2009 (in preparation)
III.2.3.3. "Clandestine Manufacture of Substances under International Control", UNODC, ST/NAR/10/Rev.2, August 1998
II.2.3.4. "Guidelines for the Safe Handling and Disposal of Chemicals Used in the Illicit Manufacture of Drugs", ST/NAR/36 rev.1, UNODC, 2011.
III.2.3.5. "Clandestine Laboratory Guide for Agents and Chemists", United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
III.2.3.6. "Chemicals used in the Clandestine Production of Drugs", US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section

III.2.3.7. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
III.2.3.8. "DRCHIS: Drugs geRelateerd CHemicalien Informatie Systeem", A. Elissen, M.L. Hordijk, Dutch National Criminal Intelligence Division, May 1999
III.2.3.9. "Manual on the production of Synthetic Drugs", Europol, The Hague, July 1999
III.2.3.10. "European Union Training Course for Trainers on the combating of Illicit Synthetic Drugs Laboratories, Course Standard", Europol, The Hague, 1999
III.2.3.11. "Forensic Investigation of Clandestine Laboratories", Donnell RC., CRC Press, 2004.
III.2.3.12. "Advanced Techniques of Clandestine Psychedelic and Amphetamine Manufacture", Uncle Fenster, Loompanics Unlimited, 1998.
III.2.3.13. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
III.2.3.14. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012

III.2.4. Assessment

III.2.4.1. Study questions (oral, written)
III.2.4.2. Practical exercise in a simulated environment of a clandestine laboratory : Investigation, risk assessment, risk management, processing of the laboratory, registration, documenting, sampling
III.2.4.3. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.1. SEPARATIONS AND EXTRACTIONS OF ILLICIT MATERIALS

IV.1.1. Objectives

IV.1.1.1. Knowledge of the principle/theory of Separations and Extractions in drug analysis:
- IV.1.1.1.1. Awareness of the factors which affect separations
- IV.1.1.1.2. Knowledge of the criteria for selection of solvent systems, including safety and cost
- IV.1.1.1.3. Familiarity with extraction techniques
- IV.1.1.1.4. Awareness of possible problems and likely causes/solutions
- IV.1.1.1.5. Use of solubility to separate mixtures of drugs and diluents
- IV.1.1.1.6 Definition of pKa and the Henderson Hasselbach equation
- IV.1.1.1.7 Basic drug extractions using aqueous/organic solvents
- IV.1.1.1.8 Acidic drug extractions using aqueous/organic solvents
- IV.1.1.1.9. Amphoteric drug extractions using aqueous/organic solvents
- IV.1.1.1.10. Neutral drug extractions using aqueous/organic solvents
- IV.1.1.1.11. Specialty (difficult) type extractions

IV.1.1.2. Knowledge of the application of Solid Phase extraction (SPE) in drug analysis.

IV.1.1.3. Knowledge of chromatographic separation techniques:
- IV.1.1.3.1. Use of preparative column
- IV.1.1.3.2. Use of Silica and Flurosil columns
- IV.1.1.3.3. Column preparation, loading and eluting

IV.1.1.4. Knowledge of the possibilities and limitations of the technique

IV.1.2. Modes of Instruction – Training Aids

IV.1.2.1. Studying of suggested references/assignments
IV.1.2.2. Clarification on questions
IV.1.2.3. Preparation of different extraction solvent reagents including review of safety precautions
IV.1.2.4. Demonstrations by trainer: execution of extraction techniques, with explanations
IV.1.2.5. Interpretation of results and discussion
IV.1.2.6. Application of extractions on reference/known samples by trainee
IV.1.2.7. Application of extractions on unknown samples by trainee
IV.1.2.8. Discussion

IV.1.3. References

IV.1.3.1. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
IV.1.3.2. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press, General reference.
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IV.1.3.8. .The Merck Index, 14th or Current Edition, Budavari, Susan, Ed., Merck and Co., Inc., General reference.
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IV.1.3.10. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012

IV.1.3.11. Forensic Chemistry, Bell, S. Pearson-Prentice Hall(2006), 1st edition, Upper Saddle River, NJ, USA. Chapter 4, pp.85-115

IV.1.4. Assessment

IV.1.4.1. Study questions (oral, written)

IV.1.4.2. Application of separation and extraction techniques on reference or known samples

IV.1.4.3. Distribution of and application of separation and extraction techniques on unknown samples (practical)

IV.1.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.2. PRESUMPTIVE TESTS : COLOUR (SPOT) TESTS, CRYSTAL TESTS, PRECIPITATION/ANION TESTS

IV.2.1. Objectives

IV.2.1.1. Knowledge of the theory and principles of the colour, crystal and anion tests
IV.2.1.2. Familiarity with the preparation, handling and storage of the reagents
IV.2.1.3. Ability to execute colour/crystal/anion tests on drugs most commonly encountered in the illicit traffic
IV.2.1.4. Ability to interpret the results obtained
IV.2.1.5. Knowledge of the possibilities and limitations of the technique
IV.2.1.6. Knowledge of quality assurance and method validation requirements

IV.2.2. Modes of Instruction – Training Aids

IV.2.2.1. Studying of suggested references/assignments
IV.2.2.2. Clarification on questions
IV.2.2.3. Preparation of different reagents including review of safety precautions
IV.2.2.4. Demonstrations by trainer: execution of the colour/crystal/anion tests, with explanations
IV.2.2.5. Interpretation of results and discussion including limitations
IV.2.2.6. Application of colour/crystal/anion tests on reference/known samples by trainee
IV.2.2.7. Application of colour/crystal/anion tests on unknown samples by trainee
IV.2.2.8. Discussion

IV.2.3. References

IV.2.3.1. "Rapid Testing Methods of Drugs of Abuse", UNODC, ST/NAR/13/Rev. 1, Feb.1995
IV.2.3.2. "Chemistry and Reaction Mechanisms of Rapid Tests for Drugs of Abuse and Precursor Chemicals", UNODC, SCITEC/6, February 1989
IV.2.3.3. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.2.3.4. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press
IV.2.3.5. "Modern Microcrystal Tests for Drugs", Fulton, C.C., (1969), "Wiley-Interscience, NY
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IV.2.3.7. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IV.2.3.8. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012
IV.2.3.9. "Studies on Colour Tests for Field Detection of Narcotic Drugs and Psychotropic Substances under International Control (No. II). Screening Colour Test and Specific Colour Test for the Detection of Non-barbiturate Sedatives and Hypnotics: Methaqualone and Mecloqualone", UNODC, SCITEC/13, December 1996
IV.2.3.10. "The Identification and Analysis of Benzodiazepines under International Control: I.Colour Tests and Chromatographic Methods", UNODC, SCITEC/1, December 1987
IV.2.3.11. "Spot Tests in Organic Analysis", Feigl F., Feigl F. and Anger V., Butterworth Heinemann, 7th edition, 2006
IV.2.3.12. "Microcrystal Test", Ono, M., Japan, 1996
IV.2.3.13. "Rapid and sensitive technique for the differentiation of the optical isomeric forms of methamphetamine and amphetamine", Cunningham, M. D. (1973). Microgram, vol. 6, No. 6, pp. 87-95
IV.2.3.14. "Spot Test Analysis; Clinical, Environmental, Forensic, and Geochemical Applications", Jungreis E, 2nd edition, Wiley-Interscience, New York, 1984/1997
IV.2.3.15. "Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", United Nations Office on Drugs and Crime, 2011 (link updated oct. 2012)
IV.2.3.16. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38,

April 2009

IV.2.3.17. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009

IV.2.3.18. U.S. Pharmacopeia National Formulary, USP XX, 1980

IV.2.4. Assessment

IV.2.4.1. Study questions (oral, written)
IV.2.4.2. Preparation of reagents (practical)
IV.2.4.3. Application of colour/crystal/anion tests on unknown sample (practical)
IV.2.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.3. THIN LAYER CHROMATOGRAPHY (TLC)

IV.3.1. Objectives

IV.3.1.1. Knowledge of the principle/theory of Thin Layer Chromatography in drug analysis:
- IV.3.1.1.1. Awareness of the factors which affect separations (stationary phase, mobile phase, sample, conditions)
- IV.3.1.1.2. Knowledge of the criteria for selection of solvent systems, including safety and cost
- IV.3.1.1.3. Familiarity with visualization techniques
- IV.3.1.1.4. Knowledge of various visualization spray reagents for various applications
- IV.3.1.1.5. Awareness of possible problems and likely causes/solutions
- IV.3.1.1.6. Knowledge of quality assurance and method validation requirements

IV.3.1.2. Knowledge of the application of Thin Layer Chromatography in drug analysis :
- IV.3.1.2.1. Familiarity with the TLC equipment and associated operational procedures (pre-treatment of plates, selection of suitable solvent systems, application of samples, running the plates, location procedures, visualization, storage of chromatograms)
- IV.3.1.2.2. Ability to design and use multi-development and two-dimensional TLC experiments
- IV.3.1.2.3. Ability to resolve issues such as spot overlapping and tailing
- IV.3.1.2.4. Practice in the use of high-performance TLC (HPTLC)
- IV.3.1.2.5. Experience with preparative techniques
- IV.3.1.2.6. Experience in quantitative TLC
- IV.3.1.2.7. Ability in the execution of TLC to reference/known samples as well as on drugs most commonly encountered in the illicit traffic

IV.3.1.3. Ability to interpret the results obtained

IV.3.1.4. Knowledge of the possibilities and limitations of the technique

IV.3.2. Modes of Instruction – Training Aids

IV.3.2.1. Studying of suggested references/assignments

IV.3.2.2. Clarification on questions

IV.3.2.3. Preparation of different development solvents/visualization reagents including review of safety precautions

IV.3.2.4. Demonstrations by trainer: execution of TLC, with explanations

IV.3.2.5. Interpretation of results and discussion

IV.3.2.6. Application of TLC on reference/known samples by trainee

IV.3.2.7. Application of TLC on unknown samples by trainee

IV.3.2.8. Discussion

IV.3.3. References

IV.3.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

IV.3.3.2. “Clarke’s Analysis of Drugs and Poisons”, A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press

IV.3.3.3. “Thin Layer Chromatography” - Analytical Chemistry by Open Learning R.Hamilton, S.Hamilton, John Wiley & Sons, Chichester, West Sussex, U.K., 1987 ISBN 0-471-91377-4 (paperback)

IV.3.3.4. “Handbook of Thin-Layer Chromatography”, Sherma J, Fried B and Sherma S, CRC Press; 3rd Rev&Ex, 2003

IV.3.3.5. “Thin Layer Chromatography: Reagents and Detection Methods”, Jork H, Funk W, Fischer W and Wimmer H, Volume 1b, VCH Verlagsgesellschaft mbH, BRD, 1994

IV.3.3.6. “Thin-Layer Chromatography”, Stahl, E., 1969. Springer-Verlag, 1969, NY

IV.3.3.7. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009

IV.3.3.8. “Controlled Substances Procedures Manual”, Virginia Department of Forensic Science,

DFS Document 221-D100, Revision 8, August 2012

IV.3.3.9. Thin-Layer Chromatography", Randerath, Kurt. "Second Edition. New York: Academic Press, 1968

IV.3.3.10. "Thin Layer Chromatography", Bauer, Karin, *et. al*. Heidelberg, Germany: EM Science, 1991

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IV.3.3.12. "Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", United Nations Office on Drugs and Crime, 2011 (link updated oct 2012)

IV.3.3.13. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009

IV.3.3.14. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009

IV.3.4. Assessment

IV.3.4.1. Study questions (oral, written)

IV.3.4.2. Preparation of reagents (practical)

IV.3.4.3. Distribution and application of TLC on unknown samples (practical)

IV.3.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.4. GAS CHROMATOGRAPHY (GC) including GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

IV.4.1. Objectives

IV.4.1.1. Knowledge of the principle/theory of Gas Chromatography (including GC/MS) in drug analysis :
- IV.4.1.1.1. Awareness of the mechanism of separations, including support materials, stationary phases, carrier gas and operating temperature, and relevant criteria
- IV.4.1.1.2. Familiarity with the various instrumental components and their functions, including injection port, column and detectors (FID, NPD, ECD, MS)
- IV.4.1.1.3. Familiarity with the MS components and their functions, including sample inlet, ionisation, ion separation, ion detection and amplification, output of results
- IV.4.1.1.4. Knowledge of the theory and mechanism of GC/MS as an identification technique, fragmentation process and spectra interpretation
- IV.4.1.1.5. Knowledge of derivatisation techniques, advantages and disadvantages
- IV.4.1.1.6. Knowledge of qualitative and quantitative determinations using GC
- IV.4.1.1.7. Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance
- IV.4.1.1.8. Knowledge of concept of quality assurance and method validation

IV.4.1.2. Ability in the application of GC and GC/MS in drug analysis :
- IV.4.1.2.1. Ability to prepare samples and avoid cross contamination
- IV.4.1.2.2. Familiarity with/practice in the GC instrumentation and software,
- IV.4.1.2.3. Familiarity with/practice in the GC/MS instrumentation and software
- IV.4.1.2.4. Familiarity with the operational procedures, including control of instrument
- IV.4.1.2.5. Knowledge of choice criteria and ability to determine suitable conditions and to design experiments aiming at optimum separations
- IV.4.1.2.6. Practice in the application of GC and GC/MS methodology for qualitative and quantitative analysis of drugs most commonly encountered

IV.4.1.3. Capacity of interpretation of the results obtained. Ability to perform library search (GC/MS) and interpret spectra

IV.4.1.4. Understanding the possibilities and limitations of the technique

IV.4.2. Modes of Instruction – Training Aids

IV.4.2.1. Studying of suggested references/assignments
IV.4.2.2. Clarification on questions
IV.4.2.3. Demonstrations by trainer: execution of GC and GC/MS analysis, with explanations
IV.4.2.4. Interpretation of results and discussion
IV.4.2.5. Application of GC and GC/MS on reference/known samples by trainee
IV.4.2.6. Application of GC and GC/MS on unknown samples by trainee, qualitative and quantitative determination
IV.4.2.7. Discussion

IV.4.3. References

IV.4.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences.
IV.4.3.2. “Clarke’s Analysis of Drugs and Poisons”, A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press
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IV.4.3.4. “A Practical Guide to the Care, Maintenance and Troubleshooting of Capillary Gas Chromatographic Systems”, Rood, Dean, Wiley-VCH, New York, 1999
IV.4.3.5. “Modern Practice of Gas Chromatography”, Grob RL and Barry EF, New York , Wiley-Interscience; 3rd Ed., 1995
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IV.4.3.7. "Gas Chromatography", Prichard E and Stuart B, Royal Society of Chemistry, 2003
IV.4.3.8. "Derivatisation Techniques for Gas Chromatography, Chromatography Today", Poole CF, Poole SK, Elsevier, 1991
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IV.4.3.17. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, Augusta 2012
IV.4.3.18. "Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", United Nations Office on Drugs and Crime, 2011 (link updated oct. 2012)
IV.4.3.19. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009
IV.4.3.20. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009
IV.4.3.21. GC instrumental manuals of laboratory.
IV.4.3.22. GC/MS instrumental manuals of laboratory

IV.4.4. Assessment

IV.4.4.1. Study questions (oral, written)
IV.4.4.2. Preparation and GC and GC/MS qualitative analysis of unknown samples (practical)
IV.4.4.3. Preparation and GC and GC/MS quantitative analysis of unknown samples (practical)
IV.4.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.5. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) including LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY (LC/MS)

IV.5.1. Objectives

IV.5.1.1. Knowledge of the principle/theory of HPLC incl. LC/MS in drug analysis:
- IV.5.1.1.1. Knowledge of the mechanism of separations, including stationary phases (columns, criteria of choice), mobile phase (types, uses, composition) and temperature
- IV.5.1.1.2. Familiarity with the various instrumental components and their functions including injections port, column and detector (DAD, MS).
- IV.5.1.1.3. Familiarity with the MS components and their functions, including sample inlet, ionisation, ion separation, ion detection and amplification, output of results
- IV.5.1.1.4. Awareness of the mechanism of HPLC incl. LC/MS as an identification technique
- IV.5.1.1.5. Qualitative and quantitative determinations using HPLC and LC/MS
- IV.5.1.1.6. Awareness of common operational problems and causes, pitfalls and troubleshooting, preventive maintenance
- IV.5.1.1.7. Knowledge of quality assurance and method validation requirements

IV.5.1.2. Knowledge of the application of HPLC and LC/MS in drug analysis :
- IV.5.1.2.1. Familiarity with the HPLC and LC/MS instrumentation and software
- IV.5.1.2.2. Familiarity with the operational procedures including control of instrument
- IV.5.1.2.3. Ability to design experiments aiming at selecting operating conditions for optimum separations
- IV.5.1.2.4. Practice in the application of HPLC and LC/MS methodology in the qualitative and quantitative analysis of drugs most commonly encountered

IV.5.1.3. Capacity of understanding and interpretation of the results obtained

IV.5.1.4. Ability to perform library search (LC/MS) and interpret spectra

IV.5.1.5. Understanding the possibilities and limitations of the technique

IV.5.2. Modes of Instruction – Training Aids

IV.5.2.1. Studying of suggested references/assignments

IV.5.2.2. Clarification on questions

IV.5.2.3. Demonstrations by trainer: execution of HPLC and LC/MS analysis, with explanations

IV.5.2.4. Interpretation of results and discussion

IV.5.2.5. Application of HPLC and LC/MS on reference/known samples by trainee

IV.5.2.6. Application of HPLC and LC/MS on unknown samples by trainee, qualitative and quantitative determination

IV.5.2.7. Discussion

IV.5.3. References

IV.5.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

IV.5.3.2. “Clarke’s Analysis of Drugs and Poisons”, A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press

IV.5.3.3. “High Performance Liquid Chromatography” - Analytical Chemistry by Open Learning, 2nd Edition, S.Lindsay, John Wiley & Sons, Chichester, West Sussex, U.K., 1992, ISBN 0-471-93115-2 (paperback)

IV.5.3.4. “High-Performance Liquid Chromatography in Forensic Chemistry”, Lurie IS, 1983

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IV.5.3.6. “Chromatographic Separations” - Analytical Chemistry By Open Learning Peter A. Sewell, Brian Clarke, David Kealey, John Wiley & Sons Ltd, 1988

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IV.5.3.8. "Mass Spectrometry – Principles and Applications", Hoffmann, E.de & Stroobant, V., editor, England, Wiley, 2001
IV.5.3.9. "Mass Spectrometry" – Analytical Chemistry by open Learning - 2nd edition, James Barker, John Wiley & Sons, University of Greenwich, 1999
IV.5.3.10. "Instrumental Data for Drug Analysis", Terry Mills III and J.Conrad Robertson, second edition,1993. – LC/MS
IV.5.3.11. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IV.5.3.12. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012
IV.5.3.13. "Liquid Chromatography/Mass Spectrometry, Systems and Applications", W.H. Mc Fadden, J.Chromatogr. Sci., 1980, 18, 97-102
IV.5.3.14. "'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated oct 2012)
IV.5.3.15. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009
IV.5.3.16. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009
IV.5.3.17. HPLC instrumental manuals of laboratory
IV.5.3.18. LC/MS instrumental manuals of laboratory

IV.5.4. Assessment

IV.5.4.1. Study questions (oral, written)
IV.5.4.2. Preparation HPLC and LC/MS qualitative analysis of unknown samples (practical)
IV.5.4.3. Preparation HPLC and LC/MS quantitative analysis of unknown samples (practical)
IV.5.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.6. INFRA-RED SPECTROSCOPY (IR including FTIR)

IV.6.1. Objectives

IV.6.1.1. Knowledge of the principle/theory of IR in drug analysis :
- IV.6.1.1.1. Knowledge of the electromagnetic spectrum
- IV.6.1.1.2. Knowledge of the theory and mechanism of absorption and of vibrational and rotational spectroscopy
- IV.6.1.1.3. The Beer-Lambert Law
- IV.6.1.1.4. Knowledge of the mechanism of IR as an identification technique, (characteristic IR group frequencies and structure/spectra correlations)
- IV.6.1.1.5. Fourier transform infrared spectroscopy (FTIR) and the different techniques (KBr, ATR etc)
- IV.6.1.1.6. Familiarity with the various instrumental components and their functions
- IV.6.1.1.7. Awareness of common operational problems and causes, troubleshooting, preventive maintenance
- IV.6.1.1.7. Knowledge of quality assurance and method validation requirements

IV.6.1.2. Knowledge of the application of IR in drug analysis :
- IV.6.1.2.1. Familiarity with the (FT)IR instrumentation and software (dispersive and interferometric spectrophotometers, data processing)
- IV.6.1.2.2. Familiarity with the operational procedures (sample purification and preparation, identification and interpretation of spectra)
- IV.6.1.2.3. Practice in the application of IR methodology in the qualitative and quantitative analysis of drugs most commonly encountered
- IV.6.1.2.4. Proper use of spectral manipulations (e.g. subtraction, baseline correction, library searching)

IV.6.1.3. Ability to select operating parameters aiming at best results

IV.6.1.4. Practice in the preparation and handling of various kinds of samples

IV.6.1.5. Practice in the application of IR methodology in the analysis of drugs most commonly encountered

IV.6.1.6. Understanding the advantages and limitations of the technique

IV.6.1.7. Capacity of interpretation of the results obtained

IV.6.1.8. Experience in quantitative IR analysis

IV.6.2. Modes of Instruction – Training Aids

IV.6.2.1. Studying of suggested references/assignments

IV.6.2.2. Clarification on questions

IV.6.2.3. Demonstrations by trainer: execution of FTIR analysis, with explanations

IV.6.2.4. Interpretation of results and discussion

IV.6.2.5. Application of FTIR on reference/known samples by trainee

IV.6.2.6. Application of FTIR on unknown samples by trainee, qualitative and quantitative determination

IV.6.2.7. Discussion

IV.6.3. References

IV.6.3.1. “Infrared Spectroscopy – Analytical Chemistry by Open Learning” W.O. George, P.S. Mcintyre, Editor: David J. Mowthorpe, John Wiley &Sons 1987

IV.6.3.2. “Fundamental of Fourier Transform Infrared Spectroscopy, Brian C. Smith, CRC Press, 1996

IV.6.3.3. British Pharmacopoeia 2007, British Pharmacopoeia Commission, 2006

IV.6.3.4. “IR Spectroscopy: An Introduction”, Günzler H and Gremlich HU, Wiley-VCH; 1st Ed., 2002

IV.6.3.5. “Handbook of Fourier Transform Raman and Infrared Spectra of Polymers”, Kuptsov AH and Zhizhin GN, Elsevier Science, 1998

IV.6.3.6. “Infrared Spectroscopy: Fundamentals and Applications (Analytical Techniques in the Sciences)”, Stuart BH, John Wiley & Sons, 2004

IV.6.3.7. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.6.3.8. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press
IV.6.3.9. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IV.6.3.10. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012
IV.6.3.11. "Instrumental Data for Drug Analysis", Terry Mills III and J.Conrad Robertson, second edition,1993.
IV.6.3.12. "Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated to last revision of document - oct. 2012)
IV.6.3.13. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009
IV.6.3.14. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009
IV.6.3.15. IR instrumental manuals of laboratory

IV.6.4. Assessment

IV.6.4.1. Study questions (oral, written)
IV.6.4.2. Sample preparation and IR qualitative analysis of unknown samples (practical)
IV.6.4.3. Sample preparation and IR quantitative analysis of unknown samples (practical)
IV.6.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.7. ULTRA-VIOLET/VISIBLE SPECTROSCOPY (UV/VIS)

IV.7.1. Objectives

IV.7.1.1. Knowledge of the principle/theory of UV/VIS in drug analysis :
- IV.7.1.1.1. Theory and mechanism of molecular light absorption and electronic transitions. Awareness of the electromagnetic spectrum.
- IV.7.1.1.2. Parameters that define electromagnetic radiation (frequency, wavelength, wavenumber)
- IV.7.1.1.3. Laws of absorption : The Beer-Lambert Law
- IV.7.1.1.4. Mechanism of UV/VIS as an identification technique, including limitations
- IV.7.1.1.5. The influence of solvents and PH on spectra (wavelength maxima and band intensities)
- IV.7.1.1.6. Mechanism of UV/VIS as an quantitation technique (basic laws, single components, multi-component systems, colourimetric measurements, difference spectrophotometry, derivative spectrophotometry)
- IV.7.1.1.7. Knowledge of quality assurance and method validation requirements

IV.7.1.2. Knowledge of the application of UV/VIS in drug analysis :
- IV.7.1.2.1. Instrumentation (colourimeters, single-beam spectrophotometers, double-beam spectrophotometers, rapid-scanning spectrophotometers, absorption cells)
- IV.7.1.2.2. Preparation and handling of various kinds of samples
- IV.7.1.2.3. Application of UV/VIS methodology in the qualitative analysis of drugs
- IV.7.1.2.4. Application of UV/VIS methodology in the quantitative analysis of drugs
- IV.7.1.2.5. Awareness of common operational problems and causes, troubleshooting, preventive maintenance

IV.7.1.3. Familiarity with the UV/VIS instrumentation and software
IV.7.1.4. Familiarity with the operational procedures
IV.7.1.5. Ability to select operating parameters aiming at best results
IV.7.1.6. Practice in the application of UV/VIS methodology in the analysis of drugs most commonly encountered
IV.7.1.7. Understanding the advantages and limitations of the technique
IV.7.1.8. Capacity of interpretation of the results obtained
IV.7.1.9. Experience in quantitative UV/VIS analysis

IV.7.2. Modes of Instruction – Training Aids

IV.7.2.1. Studying of suggested references/assignments
IV.7.2.2. Clarification on questions
IV.7.2.3. Demonstrations by trainer: execution of UV/VIS analysis, with explanations
IV.7.2.4. Interpretation of results and discussion
IV.7.2.5. Application of UV/VIS on reference/known samples by trainee
IV.7.2.6. Application of UV/VIS on unknown samples by trainee, qualitative and quantitative determination
IV.7.2.7. Discussion

IV.7.3. References

IV.7.3.1. “Basic Training Program for Forensic Drug Chemists” United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.7.3.2. “Clarke’s Analysis of Drugs and Poisons”, A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press
IV.7.3.3. “Ultraviolet and Visible Spectroscopy”: Analytical Chemistry by Open Learning, Thomas MJK and Ando DJ, John Wiley & Sons; 2nd edition, 1996
IV.7.3.4. “UV Spectroscopy, Techniques, Instrumentation and Data Handling”, Clark BJ, Frost T and Russell MA, Springer, 1993
IV.7.3.5. “Controlled Substances Training Manual”, Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IV.7.3.6. “Controlled Substances Procedures Manual”, Virginia Department of Forensic Science,

DFS Document 221-D100, Revision 8, August 2012

IV.7.3.7. "Spectrometric Identification of Organic Compounds", Silverstein RM, Webster FX and Kiemle D, 7th Ed., New York, Wiley, 2005

IV.7.3.8. "Instrumental Data for Drug Analysis", Terry Mills III and J.Conrad Robertson, second edition,1993.

IV.7.3.9. "'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated oct. 2012)

IV.7.3.10. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009

IV.7.3.11. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009

IV.7.3.11. UV/VIS instrumental manuals of laboratory

IV.7.4. Assessment

IV.7.4.1. Study questions (oral, written)

IV.7.4.2. Sample preparation and UV/VIS qualitative analysis of unknown samples (practical)

IV.7.4.3. Sample preparation and UV/VIS quantitative analysis of unknown samples (practical)

IV.7.4.4. Courtroom exercise (mini-mock trial)

IV. ANALYTICAL TECHNIQUES

IV.8. SPECIAL TECHNIQUES (NMR, CE, SPME-GC, GC-FTIR)

IV.8.1. Objectives

IV.8.1.1. Knowledge of the principle/theory of special techniques in drug analysis :
- IV.8.1.1.1. General introduction and theory of techniques
- IV.8.1.1.2. Awareness of the mechanism of techniques as an identification means
- IV.8.1.1.3. Familiarity with the various instrumental components and their functions
- IV.8.1.1.4. Awareness of common operational problems and causes, troubleshooting, preventive maintenance
- IV.8.1.1.5. Knowledge of quality assurance and methods validation requirements

IV.8.1.2. Knowledge of the application of special techniques in drug analysis :
- IV.8.1.2.1. Sample preparation
- IV.8.1.2.2. Practice in the application of methodology in the qualitative and quantitative analysis of drugs most commonly encountered
- IV.8.1.2.3. Awareness of common operational problems and causes, troubleshooting, preventive maintenance

IV.8.1.3. Familiarity with the instrumentation and software
IV.8.1.4. Familiarity with the operational procedures
IV.8.1.5. Ability to select operating parameters aiming at best results
IV.8.1.6. Practice in the preparation and handling of various kinds of samples
IV.8.1.7. Practice in the application of methodology in the analysis of drugs most commonly encountered
IV.8.1.8. Understanding the advantages and limitations of the technique
IV.8.1.9. Capacity of interpretation of the results obtained
IV.8.1.10. Experience in quantitative analysis

IV.8.2. Modes of Instruction – Training Aids

IV.8.2.1. Studying of suggested references/assignments
IV.8.2.2. Clarification on questions
IV.8.2.3. Demonstrations by trainer: execution of analysis with explanations
IV.8.2.4. Interpretation of results and discussion
IV.8.2.5. Application of technique on reference/known samples by trainee
IV.8.2.6. Application of technique on unknown samples by trainee, qualitative and quantitative determination
IV.8.2.7. Discussion

IV.8.3. References

IV.8.3.1. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IV.8.3.2. "Clarke's Analysis of Drugs and Poisons", A. C. Moffat, M. D. Osselton and B. Widdop (eds.) 3rd ed., (2004), Pharmaceutical Press
IV.8.3.3. "The Identification and Analysis of Barbiturates under International Control: I. ^{1}H Nuclear Magnetic Resonance Spectroscopy", UNODC, SCITEC/7, 1989
IV.8.3.4. "The Identification and Analysis of Benzodiazepines under International Control: II. Nuclear Magnetic Resonance Spectroscopy", UNODC, SCITEC/4, 1988
IV.8.3.5. "Infrared Spectroscopy – Analytical Chemistry by Open Learning" W.O. George, P.S. Mcintyre, Editor: David J. Mowthorpe, John Wiley &Sons 1987
IV.8.3.6. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IV.8.3.7. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012
IV.8.3.8. "Instrumental Data for Drug Analysis", Terry Mills III and J.Conrad Robertson, second edition,1993.
IV.8.3.9. "Electrophoresis" M. Melvin, ACOL - Analytical Chemistry by Open Learning ISBN: 0 471 91375 8

IV.8.3.10. "'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated oct. 2012)
IV.8.3.11. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009
IV.8.3.11. "Guidance for the Validation of Analytical Methodology and Calibration of Equipment used for Testing of Illicit Drugs in Seized Materials and Biological Specimens - ST/NAR/41", UNODC, 2009
IV.8.3.12. Instrumental manuals of laboratory

IV.8.4. Assessment

IV.8.4.1. Study questions (oral, written)
IV.8.4.2. Sample preparation and qualitative analysis of unknown samples (practical)
IV.8.4.3. Sample preparation and quantitative analysis of unknown samples (practical)
IV.8.4.4. Courtroom exercise (mini-mock trial)

V. LEGISLATION (UN, EU, NATIONAL)

V.1. Objectives

V.1.1. Knowledge of the International (UN) legislation on drugs and drug precursors (including procedures related to international transfer of reference drug and precursor samples) :
- V.1.1.1. The Single Convention on Narcotic Drugs, 1961, as amended by the 1972 Protocol amending the Single Convention on Narcotic Drugs, 1961, including national status of treaty adherence
- V.1.1.2. Convention on Psychotropic substances, 1971, including national status of treaty adherence
- V.1.1.3. Convention against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances,1988, including national status of treaty adherence and the concept of the Limited International Surveillance List for precursors and the concept of the Limited Surveillance List for precursors
- V.1.1.4. Classification of drugs and drug precursors in international legislation
- V.1.1.5. Interpol procedure for transmission of controlled substances

V.1.2. Knowledge of the European Union (EU) legislation on drugs and drug precursors :
- V.1.2.1. Regulation (EC) No 273/2004 of the European Parliament and of the Council of 11 February 2004 on drug precursors (intra Community trade)
- V.1.2.2. Council Regulation (EC) No 111/2005 of 22 December 2004 laying down rules for the monitoring of trade between the Community and third countries in drug precursors
- V.1.2.3. Commission Regulation (EC) No 1277/2005 of 27 July 2005 laying down implementing rules for Regulation (EC) No 273/2004 of the European Parliament and of the Council on drug precursors and for Council Regulation (EC) No 111/2005 laying down rules for the monitoring of trade between the Community and third countries in drug precursors
- V.1.2.4. Guidance document agreed between the Commission services and the competent authorities of Member States on the implementation of the Community legislation on drug precursors -Version 2 (non-legally binding)
- V.1.2.5. Council Decision 2005/387/JHA of 10 May 2005 on the information exchange, risk-assessment and control of new psychoactive substances
- V.1.2.6. Council Decision 2001/419/JAI of 28 May 2001 on the transmission of samples of controlled substances
- V.1.2.7. New legal developments on drugs and drug precursors
- V.1.2.8. Key EU activities on drugs and drug precursors
- V.1.2.9. Surveillance List
- V.1.2.10. Classification of drugs and drug precursors in EU legislation

V.1.3. Knowledge of the national legislation on drugs and drug precursors
- V.1.3.1. National legislation (including amendments) on drugs and drug precursors (legal texts, reports and policy)
- V.1.3.2. National strategy and action plan on drugs and drug precursors
- V.1.3.3. Co-ordination arrangements, mechanisms and national authorities in the field of drugs and drug precursors
- V.1.3.4. Structure and organization of forensic agency, field of competence
- V.1.3.5. Classification of drugs and drug precursors in national legislation

V.2. Modes of Instruction – Training Aids

V.2.1. Presentation and studying of relevant legal texts
V.2.2. Clarification on questions
V.2.3. Discussion

V.3. References

V.3.1. UNODC Treaties
V.3.2. "Multilingual Dictionary of Narcotic Drugs and Psychotropic Substances Under International Control (MLD)", UNODC, ST/NAR/1/rev.2, December 2006
V.3.3. Online issues of the EU Official Journal from 1998 onwards

V.3.4. Search in the Register of European Council legislative acts
V.3.5. EMCDDA publications database
V.3.6. EU drugs action plan (2009–12)
V.3.7. Access the official databases of national legislation in 23 EU countries
V.3.8. National legislation on drugs and precursors
V.3.9. Organizational legal texts
V.3.10. "Guidelines for the import and export of drug and precursor reference standards for use by national drug testing laboratories and competent national authorities", INCB, UNODC, 2007
V.3.11. "World Drug Report 2011" UNODC

V.4. Assessment

V.4.1. Study questions (oral)
V.4.2. Courtroom exercise (mini-mock trial)

VI. PROCEDURES

VI.1. Objectives

VI.1.1. Knowledge of the procedures applied in the collection, receipt, protection, handling, storage, analysis of samples/evidence, as well as documentation, evaluation, report writing and communication of results

VI.1.2. Ability to choose the best case approach, preparation of samples and handling of evidence, implementation of analytical schemes and methodology, and reporting of results, for each individual case

VI.1.3. Ability to interpret and handle analytical data and related information so as to create and use respective databases

VI.2. Modes of Instruction – Training Aids

VI.2.1. Studying of, clarification of questions and discussion on documentation of the administrative, organizational and scientific/analytical aspects of laboratory work (e.g. Quality Manual, Best Practices manual, SOP's etc)

VI.2.2. Demonstration/guidance by trainer with explanations on standards or protocols implemented with respect to :

- case approach
- general analytical schemes for unknown samples / powders / tablets / capsules / herbal material
- weighing practices
- sampling practices
- choice of analytical methodology
- validation/verification of methods
- application of techniques per substance(s)
- development of SOPs
- equipment performance and control, preventive maintenance
- quality control
- interpretation and reporting of the results
- documents and case records
- handling/storage of samples/evidentiary material
- handling/storage of information, access to databases
- chain of custody
- communication with clients (including communication language, establishing needs, dealing with undue pressure etc)
- health and safety
- responsibilities, duties and skills of the personnel
- education and training of personnel

VI.2.3. Practice in implementation of the (best) practices, (quality assurance) principles and criteria of the laboratory, at technical and management level

VI.2.4. Discussion

VI.3. References

VI.3.1. Procedures Manual(s) of the laboratory

VI.3.2. "ENFSI Code of Conduct", ENFSI/QCC, Ref.Code BRD-GEN-003, Issue No 002, 16 June 2005 (link updated oct 2012)

VI.3.3. "Guidance for the Implementation of a Quality Management System in Drug Testing Laboratories", United Nations Office on Drugs and Crime, ST/NAR/37, March 2009

VI.3.4. "'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated oct. 2012)

VI.3.5. "Validation of analytical methodology and calibration of equipment used for testing of illicit drugs in seized materials and biological specimen", United Nations Office on Drugs and Crime, 2009

VI.3.6. "Glossary of Terms for Quality Assurance and Good Laboratory Practices", United Nations Office on Drugs and Crime, ST/NAR/26/Rev.1, December 2009

VI.3.7. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April

2009
VI.3.8. "Recommended Guidelines for Quality Assurance and Good Laboratory Practice" United Nations Office on Drugs and Crime, STR/NAR/25, 1995
VI.3.9. "Guidelines for Forensic Science Laboratories", International Laboratory Accreditation Cooperation, ILAC-G19:2002
VI.3.10. "Guidelines for the import and export of drug and precursor reference standards", The International Narcotics Control Board (INCB), 2007
VI.3.11. "Recommendations", Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) (link updated oct. 2012)
VI.3.12. "Guidelines on the use of reference materials in forensic drug analysis", European Network of Forensic Science Institutes (ENFSI/002)
VI.3.13. "Guidance on the production of best practice manuals within ENFSI", ENFSI QCC-BPM-008, 2008
VI.3.14. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, rev.1, February 2009
VI.3.15. Furr AK, "Handbook of Laboratory Safety", CRC Press, 5th Ed., 2000
VI.3.16. Armour M A, "Hazardous Laboratory Chemicals Disposal Guide", 3rd edition, CRC, 2003
VI.3.17. "Prudent Practices in the Laboratory", National Research Council (U.S.), Committee on Prudent Practices for Handling, Storage, and Disposal of Chemicals in Laboratories, National Academies Press, 1995
VI.3.18. "Handbook of Laboratory Health and Safety", Sticoff RS, and Walters DB, 2nd edition, John Wiley & Sons, 1995
VI.3.19. "Sampling for Analytical Purposes", Gy P, John Wiley & Sons Ltd., 1998
VI.3.20. "ASTM E 1459-92: Standard Guide for Physical Evidence Labelling and Related Documentation", American Society for Testing and Materials, West Conshohocken, Pennsylvania
VI.3.21. "ASTM E 1492-05: Standard Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory", American Society for Testing and Materials, West Conshohocken, Pennsylvania
VI.3.22. "Interpreting Evidence - Evaluating Forensic Science in the Courtroom", Robertson B, Vignaux GA, John Wiley & Sons, Chichester, West Sussex
VI.3.23. "Analytical Instrumentation - Performance Characteristics & Quality", Currell G, John Wiley & Sons, 2000
VI.3.24. "Applications of Reference Materials in Analytical Chemistry", Barwick V et al, The Royal Society of Chemistry, LGC, Teddington, 2001
VI.3.25. "Sample Pretreatment and Separation", Analytical Chemistry by Open Learning, R. G. Anderson, John Wiley & Sons, Chichester, West Sussex, UK, 1987
VI.3.26. "Samples and Standards", Analytical Chemistry by Open Learning, B.W.Woodget, D.Cooper, John Wiley & Sons, Chichester, West Sussex, UK, 1987
VI.3.27. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences

VI.4. Assessment

VI.4.1. Study questions (oral, written)
VI.4.2. Practical exercise on the implementation of procedures in compliance with the Quality Management System of the laboratory, at all stages of processes

VII. HEALTH AND SAFETY ISSUES

VII.1. Objectives

VII.1.1. Knowledge about safe working practices in the laboratory and at crime scene
VII.1.2. Ability to prevent service-related accidents, injuries, illnesses of personnel and damage to equipment, at laboratory and at crime scene
VII.1.3. Ability to assess and manage risk and emergency situations
VII.1.4. Active participation in implementation of safe working systems including evaluations and review. Consequent development of safety consciousness
VII.1.5. Ability in safety documenting including maintenance of a safety manual, including designated staff, emergency procedures, contact information, training, accommodation, personal protective equipment, general hygiene/safety and biological/radioactivity hazards, risk assessment and risk management

VII.2. Modes of Instruction – Training Aids

VII.2.1. Studying of, clarification of questions and discussion on :
- VII.2.1.1. legal and organisational requirements
- VII.2.1.2. properties of hazardous materials, including incompatibilities
- VII.2.1.3. use/meaning of hazard identification symbols, Risk and Safety phrases
- VII.2.1.4. interpretation of Material Safety Data Sheets
- VII.2.1.5. safety guidelines (in the laboratory and at crime scene), precautions and rules/procedures with respect to handling compressed gases, flammable, toxic and corrosive substances, bio-hazardous materials, glassware, high-intensity light sources (including UV lamps and lasers), etc, including safe transportation, storage and disposal.
- VII.2.1.6. hazards involved with analytical instruments and apparatuses operation (high temperatures, radiation etc)
- VII.2.1.7. dealing with risk and emergency situations
- VII.2.1.8. scientific and technical literature on the issue

VII.2.2. Demonstrations by trainer with explanations on :
- VII.2.2.1. use of (personal) protective equipment and physical barriers that are used both to protect the analyst from the evidence and reagents, and the evidence from the analyst, including capabilities and limitations
- VII.2.2.2. use of fire fighting equipment
- VII.2.2.3. first aid and emergency procedures

VII.2.3. Practice in :
- VII.2.3.1. implementation of safe working procedures in the forensic laboratory and at a crime scene, including handling chemicals as well as unknown and potentially hazardous evidence

VII.2.4. Clarification on questions
VII.2.5. Practical exercise on :
- VII.2.5.1. implementation of risk assessment of hazardous chemicals/material and situations
- VII.2.5.2. implementation of risk management and procedures that have been adopted to maintain health and safety and to provide a safe working environment for the employees

VII.2.6. Discussion

VII.3. References

VII.3.1. "Recommended Guidelines for Quality Assurance and Good Laboratory Practices" United Nations Office on Drugs and Crime, ST/NAR/25, 1995
VII.3.2. "Guidance for the implementation of a quality management system in drug testing laboratories – a commitment to quality and continuous improvement, United Nations Office on Drugs and Crime, ST/NAR/37, 2009
VII.3.3. "Guidelines for the Safe Handling and Disposal of Chemicals Used in the Illicit Manufacture of Drugs", ST/NAR/36 rev.1, UNODC, 2011.
VII.3.4. "Data Sheets on Substances Frequently Used in the Illicit Manufacture of Narcotic Drugs or Psychotropic Substances", SCITEC/9/REV.1, April 1993

VII.3.5. "Recommendations", Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) (link updated oct. 2012)
VII.3.6. "NIOSH Pocket Guide to Chemical Hazards", Department of health and human services, National Institute for Occupational Safety and Health, 2005 (link updated oct. 2012)
VII.3.7. "Guidelines for Laboratory Design: Health and Safety Considerations", Di Berardinis JL, Baum JS and First MW, Wiley, 2nd edition, 1992
VII.3.8. "DRCHIS: Drugs geRelateerd CHemicalien Informatie Systeem", A. Elissen, M.L. Hordijk, Dutch National Criminal Intelligence Division, May 1999
VII.3.9. "Chemicals used in the Clandestine Production of Drugs", US Department of Justice, Drug Enforcement Administration, Office of Diversion Control, Drug and Chemical Evaluation Section
VII.3.10. Relevant material safety data sheets
VII.3.11. "Handbook of Laboratory Safety", Furr AK, CRC Press, 5th Ed., 2000
VII.3.12. "Hazardous Laboratory Chemicals Disposal Guide", Armour M A, 3rd edition, CRC, 2003
VII.3.13. "Prudent Practices in the Laboratory", National Research Council (U.S.), Committee on "Prudent Practices for Handling, Storage, and Disposal of Chemicals in Laboratories, National Academies Press, 1995
VII.3.14. "Handbook of Laboratory Health and Safety", Sticoff RS, and Walters DB, 2nd edition, John Wiley & Sons, 1995

VII.4. Assessment

VII.4.1. Study questions (oral, written)
VII.4.2. Practical exercise
VII.4.3. Courtroom exercise (mini-mock trial)

VIII. QUALITY ISSUES

VIII.1. Objectives

VIII.1.1. Awareness of the significance of the quality of analyses and forensic laboratory results for the law enforcement, justice system, crime prevention and health, as well as for the international harmonization and worldwide exchange and coordination of drug information and data
VIII.1.2. Knowledge of the Quality policy of the laboratory
VIII.1.3. Knowledge of the requirements of ISO 17025, as interpreted for forensic laboratories
VIII.1.4. Knowledge of the structure of the Quality Management System of the laboratory or of the Best Practices applied
VIII.1.5. Ability to comply with the technical requirements established in the Quality Management System and/or Quality Standards of the laboratory
VIII.1.6. Ability to comply with the management requirements established in the Quality Management System and/or Quality Standards of the laboratory

VIII.2. Modes of Instruction – Training Aids

VIII.2.1. Presentation by trainer and discussion on :
- VIII.2.1.1. national legislative, jurisdictional and regulatory requirements
- VIII.2.1.2. institutional and organizational requirements of the laboratory
- VIII.2.1.3. client requirements
- VIII.2.1.4. external and/or international instructions, recommendations and guidelines
- VIII.2.1.5. principles of ethical conduct

VIII.2.2. Studying of, clarification of questions and discussion on :
- VIII.2.2.1. Standard ISO/IEC 17025
- VIII.2.2.2. Quality Manual, and/or other relevant documentation of the administrative, organizational and scientific aspects of laboratory work (e.g. Best Practices manual, SOP's etc)

VIII.2.3. Demonstration by trainer with explanations on the laboratory quality management system and the quality standards/protocols implemented with respect to :
- VIII.2.3.1. organization of the laboratory
- VIII.2.3.2. laboratory environment and accommodation
- VIII.2.3.3. responsibilities, duties and skills of the personnel
- VIII.2.3.4. equipment choice and performance - calibration
- VIII.2.3.5. key stages of the drug testing process :
  - case assessment
  - sampling
  - handling of samples and evidentiary material
  - development of methods
  - development of procedures
  - validation/verification of methods
  - quality control (internal-external)
  - interpretation and reporting of the results
- VIII.2.3.6. chain of custody
- VIII.2.3.7. documents and case records
- VIII.2.3.8. handling of services and supplies
- VIII.2.3.9. dealing with clients, requests and complaints
- VIII.2.3.10. audits, corrective and preventive actions
- VIII.2.3.11. health and safety
- VIII.2.3.12. drug reference materials
- VIII.2.3.13. education and training of personnel
- VIII.2.3.14. proficiency testing

VIII.2.4. Practice in :
- VIII.2.4.1. implementation of the quality assurance principles and criteria of the laboratory, at technical and management level
- VIII.2.4.2. use of quality assurance system as a safeguard to legal scrutiny

VIII.2.5. Discussion

VIII.3. References

VIII.3.1. "Guidance for the Implementation of a Quality Management System in Drug Testing Laboratories", United Nations Office on Drugs and Crime, ST/NAR/37, March 2009

VIII.3.2. "'Staff Skill Requirements and Equipment Recommendations for Forensic Science Laboratories", UNODC, 2011 (link updated oct. 2012)

VIII.3.3. "Validation of analytical methodology and calibration of equipment used for testing of illicit drugs in seized materials and biological specimen", United Nations Office on Drugs and Crime, 2009

VIII.3.4. "Glossary of Terms for Quality Assurance and Good Laboratory Practices", United Nations Office on Drugs and Crime, ST/NAR/26/Rev.1, December 2009

VIII.3.5. "Guidelines on Representative Drug Sampling", UNODC & ENFSI DWG, ST/NAR/38, April 2009

VIII.3.6. "Recommended Guidelines for Quality Assurance and Good Laboratory Practice" United Nations Office on Drugs and Crime, STR/NAR/25, 1995

VIII.3.7. ISO/IEC 17025:2005 General Requirements for Competence of Testing and Calibration Laboratories, International Organization for Standardization/International Electrotechnical Commission

VIII.3.8. "Guidelines for Forensic Science Laboratories", International Laboratory Accreditation Cooperation, ILAC-G19:2002

VIII.3.9. "Recommendations", Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) (link updated oct. 2012)

VIII.3.10. "Guidance on the production of best practice manuals within ENFSI", ENFSI QCC-BPM-008, 2008 (link updated oct. 2012)

VIII.3.11. Quality Manual of the laboratory

VIII.4. Assessment

VIII.4.1. Study questions (oral, written)

VIII.4.2. Practical exercise on the implementation of procedures in compliance with the Quality Management System of the laboratory, at all stages of processes

VIII.4.3. Courtroom exercise (mini-mock trial)

IX. COURTROOM TESTIMONY

IX.1. Objectives

IX.1.1. Familiarity of the trainee with the environment of a courtroom
IX.1.2. Familiarity of the trainee with the functions of a courtroom criminal proceeding
IX.1.3. Preparation of a Curriculum Vitae by the trainee
IX.1.4. Familiarity of the trainee with "voir dire" questioning during testimony
IX.1.5. Familiarity of the trainee with presenting expert testimony during direct questioning
IX.1.6. Familiarity of the trainee with defending analytical results during cross-examination

IX.2. Modes of Instruction – Training Aids

IX.2.1. Studying of suggested references/assignments
IX.2.2. Clarification on questions
IX.2.3. Observation of court testimonies by experienced experts
IX.2.4. Practical exercise (mini-mock trials) based on case-studying
IX.2.5. Discussion

IX.3. References

IX.3.1. "Kuzmack, Nicholas T., J.D., M.A. "Legal Aspects of Forensic Science", in Saferstein, Richard, Ph.D., editor. Forensic Science Handbook. Englewood Cliffs, N.J.: Prentice Hall, 1982, pp. 1-27
IX.3.2. "Shellow, James M. "The Expert Witness in Narcotics Cases", in Contemporary Drug Problems – A Law Quarterly, Spring 1973, pp 81-104.
IX.3.3. "Travnikoff, Basil, Jr. and Kvick, Robert J. "How to Examine a Chemist in Drug Abuse Cases", First Edition, 1971
IX.3.4. "Bailey, F. L. and Rothblatt, H. B., Handling Narcotic and Drug Cases, Rochester, NY: The Lawyers Cooperative Publishing Co., 1972.
IX.3.5. "Basic Training Program for Forensic Drug Chemists" United States Department of Justice, Drug Enforcement Administration, Office of Forensic Sciences
IX.3.6. "Controlled Substances Training Manual", Virginia Department of Forensic Science, DFS Document 221-D200, Revision 1, February 2009
IX.3.7. "Controlled Substances Procedures Manual", Virginia Department of Forensic Science, DFS Document 221-D100, Revision 8, August 2012
IX.3.8. National, EU and International Legislation on Drugs and Precursors

IX.4. Assessment

IX.4.1. Study questions (oral, written)
IX.4.2. Practical exercise in a simulated environment of a courtroom testimony :
- Direct questioning
- Cross-examination